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Professional Knowledge, Expertise and Perceptual Ability

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I. Introduction

This article addresses the role of perceptual knowledge (knowledge by acquaintance) in the development of expertise in professional contexts. It seeks to answer the question as to how, if at all, does heightened knowledge by acquaintance inform a high level of professional know-how? In many professional contexts, successful action requires the articulation of various epistemic capacities: to draw on relevant systematic knowledge, to understand the nature of the problem faced, to perceive the essentials in complex situations and to judge and then to act appropriately. The aim will be to bring together philosophical and empirical considerations to show how best to understand the ability to perceive the essentials in complex situations and how this ability bears on the ability to judge and to act appropriately in professional contexts.¹

II. Perception Plays a Different Role in Different Language Games.

It is through acting on and reacting to our environment, natural and social, that we acquire perceptual concepts. We acquire them in a social milieu in which we learn to recognise and speak about those things in our environment that affect and interest us. The language games that we thus learn to participate in concern relatively permanent features of our environment, shared with others (Strawson 1961). The concepts that we possess of substances, processes, events and other people are acquired through action and observation, but necessarily also through learning our native language through interaction with adults. Perceptual concepts are acquired through social intercourse, rather than through introspection and labelling. They are made manifest through our attempts to communicate and to act on the world. They grow through our participation in *normative activities* (Baker and Hacker 1985) in which adults play a predominant role.

We also acquire psychological concepts and concepts of sensation through the same means, but our acquisition of sensation concepts depends on our prior grasp of perceptual concepts. We learn about colour, texture, solidity, viscosity etc. through

¹ The distinction between judging and acting in a professional situation is made to take account of 'knowing to' examples (see Wiggins 2012 for examples).

encountering objects, processes and events that manifest such properties and we learn the language of perception through communication with adults in the course of such experiences. Learning to report on our own states, using the same or similar vocabulary, occurs when we acquire the ability to apply to ourselves concepts that we first applied to our environment, to other people or which were applied to ourselves by others.² For example, we learn the concept of an after-image after first learning the concept of an object, such as the Sun, which is capable of leading to such an after-image. The range of concepts associated with ‘how it seems to me’ or ‘it looks different in this setting’ and so on are acquired after ‘it is an animal’ or ‘the sky is blue’. The discriminatory power and the richness of our conceptual command grow through close engagement with our environment and intercourse with our peers and elders in the everyday settings of family and immediate environment; they are not first learned through introspection and reflection on our experiences, sensations or feelings, although these can play a role in further conceptual development.

Those features of the environment that are most salient to us and which impact most forcibly on us and our interests, orient our enquiries and our learning. Our discriminatory and more finely nuanced conceptual abilities arise through the attention that we give to such matters as concern us most in everyday life. In addition, our curiosity about adult concerns allows us to build up a picture, albeit incomplete and sometimes distorted, of the conceptual structure of the social world into which we are becoming inducted (Tizard and Hughes 1984). Our orientation to the world is shaped by the impact of the environment and of others on us and by our curiosity concerning how the world works. We notice some things and not others and our orientation is a reflection of a discriminating and selective approach to the world around us that of necessity excludes and glosses over some aspects that do not concern us so deeply.

The orientation to the world and the concerns of other cultures can take forms that are unexpected and difficult for us to grasp. For example, it is natural to assume that the part of our conceptual scheme concerned with colour reflects a universal human orientation and that, although we can expect cultural variation according to interest (for example heightened discriminatory abilities and an associated vocabulary related

² See Child 2015 for more on the development of phenomenal concepts without the use of a private language.

to snow amongst peoples living in the High Arctic), we find it disorienting to have it suggested that perhaps concepts of colour do not exist or exist in a form substantially at variance to our own, as in the example given by Ma and van Brakel (2016) of ancient Chinese oracle bone discourse, in which they argue that the perspective through which we should see what we call colour concepts in that outlook is best approached through what they call ‘cattle – fur – appearance –discourse’ (CFAD) in which the prominence of “appearance features such as the smoothness of the animal fur, its dullness/brightness, its chromatic hue, its being variegated or not, showing patterns or not, its appearance at dawn and similar appearance features, as well as related evaluative features” (pp. 274-275) are the appropriate way of interpreting a language game closely related to those associated with what we call ‘colour’. If this interpretation is correct, then the expert studying these oracle bones may require a perceptual orientation different from the ‘comfort zone’ of colour language games within which he is accustomed to think.

III. *Perception and Expertise.*

When we speak of expertise, we are not talking about this common world which we all share, albeit with different emphases and nuances, but of specialist fields of occupational activity the performance of which is appraisable, often to a very fine and discriminating degree, by fellow-experts. But such fields would not be within our grasp had we not first learned to operate in the everyday, non-expert world. Nevertheless, even within this everyday world, the site of our earliest actions, concepts of appraisal of action are important. Knowing how, as Ryle (1949) points out, is manifested in actions which are appraisable in terms of their technical, moral and aesthetic qualities. When we attribute expertise to someone, we build on already existing abilities to appraise action, abilities which are themselves an integral element in our concept of know-how. What is the connection then between our early perceptual abilities and our grasp of what know-how involves and the attributes of expertise that we value in professional activities?³

In all human life there are *divisions of labour*. Some people do things that other do not, or do to a less accomplished level. This is something more fundamental than the

³ The discussion here refers to both *constitutive* and *relative* expertise – see Introduction to this volume.

modern organisation of work, it is a feature of all life; in the domestic, leisure and religious spheres as much as in the workplace.⁴ It is within the division of labour in which most of our activity is situated that we adopt a distinctive stance towards the relevant environment, the people within it and the instruments that we use. The division of labour orients us in certain directions rather than others and this is reflected in the salience which certain features of our environment enjoy relative to others, within the field of both perception and discourse. The two are intimately connected. For a carpenter, the workshop is organised with carpentry in mind. As Heidegger points out, for the carpenter, the layout of the workplace, the location of tools and materials are salient in a way that they would not necessarily be for a customer or a visitor. The salience of the workshop and its work-relevant features to the carpenter is a stance that the carpenter must perforce have.⁵

This perceptual stance does not mean that the carpenter sees a different workshop from the customer or visitor, rather that the ordering of importance and hence of notice and attention are different for him. That this ordering is different is a necessary condition of his ability to act effectively as a carpenter. For him, *qua* carpenter, the workspace is organised in a way apt for the practice of his occupation. The perceptual salience of carpentry-related phenomena extends beyond the workplace. The carpenter will notice features of other carpenters' work in the wider world and will take note of materials, joints and other features of workmanship that will remain unnoticed by those not in his profession. Such stances are an unavoidable consequence of the division of labour and constitute the foundation of our ability to perceive and to make judgements about the actions of other workers in the same field. The ability to act appropriately involves perceiving and understanding the nature of the situation faced. It is thus brought within a conceptual field that frames the situation perceived by the agent and gives rise to consideration of potential courses of action, themselves constrained by knowledge of what is feasible.

We have thus set the stage for considering the contribution that perceptual ability plays in acquiring, practising and judging expertise. A more or less permanent orientation of perception towards objects, events and processes that bear directly on the occupation is a necessary feature of practising that occupation to a threshold

⁴ See Weil (1955) pp. 133-4.

⁵ See Weil (1978), p.50.

degree of competence, let alone to a degree of expertise.⁶ What Wittgenstein calls ‘chronic’ aspect perception is not only one of the foundations of any expert activity, but is also characteristic of our everyday stance *vis a vis* the world or knowing our way about’. (cf. Arahata 2015, p.119; Wittgenstein 1953: e.g II. 180; 1980a: 295, 1004, 1009; 1980b 458, 506).⁷ There is thus a permanence in importance of certain features of the environment that can be grasped, not just in what humans say about their environment, but also in how they act on and react to their surroundings, what Weil calls ‘une sorte de danse’, the elementary expression of our perceptual abilities (Weil 1978, p.50).

Although I have argued that perception primarily concerns how we relate to the world of objects, processes etc., we need also to be aware of the fact that we can also use the verb ‘see’ and its cognates to describe our *experiences* (see ter Hark 2015; McGinn 2015). These two forms of perceptual language are closely entwined with one another, although the former is primary in the sense that it must be the ground for the other. I cannot talk about my experiences without using language and employing concepts that belong both to the public world and to what is perceived in it: objects, persons, processes, events, states of affairs etc. For reasons given by Wittgenstein, it is not possible to build up perceptual concepts *ab initio* through attention to my experiences. On the other hand, it is possible to use perceptual concepts to direct attention to how things seem to me, to how I see them as, what they look like to me and what possibilities are contained in them.

Here there are cases that differ in important ways. In a certain light a tree looks blue to me, and there is no doubting that I am looking at a tree. Likewise, when I look at an object from a certain angle, something that is actually three-dimensional may look flat, but there is something which is actually three-dimensional. On the other hand, to use Marie McGinn’s example, I may see a resemblance between two faces. “I am not asserting that there is some demonstrable look that they both have and which anyone who sees them will see, but that *I* see or am struck by a similarity which I recognise

⁶ It is important to distinguish this kind of aspect perception from what Wittgenstein calls ‘continuous’ aspect perception, which occurs not just when I perceive the transition from duck to rabbit in, for example, the Jastrow drawing in *Philosophical Investigations* II p.194, but when I see the rabbit as long as my attention is focussed on it (see Arahata 2015 for a more detailed discussion).

⁷ Thus Ma and van Brakel (ibid.) speculate that the CFAD discourse is predicated on the salience of mammals such as oxen and horses in a particular form of life.

others may not see.” (McGinn 2015, p.41). McGinn goes on to point out that the criterion of my seeing the similarity is my sincere evocation of that similarity. That others do not perceive it does not detract from my claim. The criterion is not the same as for cases where I perceive something that is manifestly observable by others in the right circumstances, but does share this criterion with other cases such as puzzle pictures, imperfect sight, and aspect change (op.cit. pp.35 - 41).

What is the relationship between the possession of concepts and perceptual ability? The everyday life into which a child grows up gives a pattern to experience which the acquisition of a conceptual structure within that life makes possible. Animals also live in a world in which those features which are salient for them give a pattern to their experience. They do not and cannot acquire a conceptual structuring of that world, but humans, like animals, form our conceptual structure around a more instinctive patterning which corresponds to our animal needs and preoccupations. Our growing participation in a social world is accompanied by a growing conceptual differentiation of our experience.⁸ This is not to say that we have a distinguishable concept for everything that we perceive, but rather that our experience is conceptually structured and where there are ‘holes’ in it, those holes are located in a common conceptual geography and can be ‘plugged’ through ostension or other means of drawing the attention of others to the phenomena of interest (see Luntley 2011 for example on ‘activity concepts’). From initial concept acquisition comes enough mastery to account for concept possession. Specialist activity, driven through the division of labour referred to earlier, brings about further growth into what can be termed *concept mastery* (Winch 2016) which allows for the further fine discrimination of both the objects of perception and of our experiences of them.

Continuous and transient aspect perception

Wittgenstein’s later discussions of perception are best known for their focus on aspect seeing and in particular on aspect change, and to a lesser extent, on continuous aspect seeing. However, the cases that Wittgenstein draws our particular attention to are part of a larger concern to illustrate the variety of phenomena that we call ‘seeing’ (and by

⁸⁸ Here I agree with Rödl (2016) that this unfolding potential is a human one, it is not a case of an neonate animal potential being changed into a human one through socialisation.

implication, hearing, tasting etc.).⁹ We should not, therefore, be fixated on the much-discussed duck/rabbit case, but consider a range of cases relevant to our concern with perception in expertise.

Let us begin though with aspect change. In aspect change cases, Wittgenstein writes about the experience of seeing something as something else, the example used in the *Philosophical Investigations* being Jastrow's duck/rabbit, which can be seen either as a duck or a rabbit's head (but not as both simultaneously) (Wittgenstein 1953 p.194). Noticing an aspect change is a distinctive kind of experience, not to be identified with the particular saliences that the world as for us in terms of our natures and preoccupations (see above). There is an entanglement of perception with thought (PI II, pp. 211-212) and with the will (p.213). One has to *think* of the drawing as the representation of the head of a rabbit rather than a duck and this involves bringing into play elements of one's concept of a rabbit (the shape of the head, long ears). Being capable of noticing aspect change presupposes prior possession of a certain concept or group of related concepts. It can also be that noting a change of aspect (eg from duck to rabbit) requires an effort of attention and concentration on the viewer's part, something which is not usually associated with everyday cases of perception (although, as we shall see, very often associated with perception associated with expertise). Likewise with the case where someone has to 'hold' the duck aspect which constantly threatens to revert to a rabbit. Wittgenstein refers less frequently to continuous aspect perception (eg PI II, p.194), which are cases where a particular aspect is seen continuously over a period of time, without the experience of the dawning of an aspect. In such cases the temptation to claim that the Jastrow drawing is *interpreted* as, say, a rabbit, is dissipated since in such cases it is apt to talk of someone always seeing a rabbit drawing until another possibility is pointed out (McGinn op.cit. pp.42-43).¹⁰

⁹ See McFee 1999 for this important point.

¹⁰ One case of interpretation would be where someone can see the Jastrow drawing as a rabbit but is unable to see it as a duck. I might say to such a person, 'you need to rotate the drawing through 90 degrees anticlockwise and now compare it with this Audubon drawing of an eider duck - can you see that there is a resemblance here?' The response might be either 'yes, now I *can* see it as a duck's head', in which case she is brought to see the aspect, or it might be, 'I can see what you are getting at - the drawing might be interpreted as a duck's head because of the shape resemblance of the drawing to a duck's head, but I still cannot visualise it as a duck's head'. In this latter case the drawing is interpreted as a duck's head, without being seen as such. The need to interpret the drawing in one way rather than another can be seen as an example of what Wittgenstein calls 'aspect blindness'.

Having considered the most discussed type of case in Wittgenstein's account of the complexities of perception, taking these as a 'disorienting'¹¹ starting point for considering the variety of cases of seeing which in various ways involve thought, imagination, will or memory, I will consider a wider set of related phenomena of seeing which are relevant to expert perception. Following McFee (1999), I take the spirit of Wittgenstein's discussion to be the variety of interconnected cases, some of which he did not explicitly discuss but which illustrate his larger point about perception. We shall see that the aspect changing and aspect permanence of expert perception are not as important as some other cases.

Seeing detail (this is a non-intentional case).

The clearest type of case is that of noticing detail that others may not notice. This is a situation that will arise frequently in the contrast between an expert and a non-expert. The detail may occur in many forms, such as noticing hidden objects, fine shades of a colour or audial, olfactory or gustatory nuances that are beyond the range of the non-expert. Although there are non-educated differences in our ability to see detail, there can be little doubt that we can be trained to look for detail in a way that would not be available to use without instruction and practice.

Thus, artists can be trained to look out for particular colour shades and details of particular brush strokes, the biologist or botanist can be trained to spot detail in fragments of fossils,¹² which the untrained eye would not be able to discern and the radiographer to spot patches in an X-ray slide which a layman would not see. The ability to spot detail is a fundamental part of the work of many occupations and it is frequently the case that sustained ability to discern detail in a situation or representation is critical to the development of expertise in a particular area. Consider the ability to note detail in microscopic slides for a biologist, slight changes of position of objects in a sequence of telescope sightings or subtleties of spectral charts for an astronomer or a particular sequence of leg and body movements for a football referee. This last example and that of the use of the telescope reminds us that the ability to spot detail in dynamic situations is often very important for the practice of certain occupations. In such cases the ability to spot detail in a rapidly evolving

¹¹ 'disorienting' here refers to the use of examples that persuade us to see complexities in perception which we did not see before.

¹² See Gould (1989) esp. Ch.3.

situation (eg a game of football) leads readily to anticipation of what is likely to happen next, that takes the observer beyond the mere seeing of the detail. For example I see the actions of the players on the left and right wings respectively as the development of an attack. Thus, the ability to see detail can have a very close connection with seeing which involves imagination and thinking. In such cases material perception (seeing detail) easily slides over into a case of intentional perception (seeing an attacking formation developing), where the sincerity of the observer's attribution is the criterion of occurrence.

Seeing in.

Another, related type of case which McFee, following Wollheim (1980, pp.213-216), calls 'seeing in' is also non-intentional in Anscombe and McGinn's sense. I see a nude lady in the painting before me. I see the arrangement of colour as a painting (I understand the representational conventions here: I have been brought up to regard paint marks within a rectangular frame as representations). I see the representation of the lady within the painting. I thus see the arrangement of paint as a representational object and see the lady situated within the painting (Wollheim and McGee refer to the twofold character of seeing in). This seems to be a case of material perception, where the object of perception is non-intentional. For anyone trained in the perception of representational art this arrangement of paint on the wall before me is a representation within which I recognise further conventions, thus seeing that there is a lady in the painting (discussed in McFee 1999, p.275). As McFee remarks, this type of case cannot be modelled as aspect perception. The 'seeing in' phenomenon typically occurs across a wide range of professional situations, such as the use of maps and blueprints.

However, there are also cases related to *seeing in* which do seem to have a significant intentional aspect. In such cases, the *seeing as* locution may be more appropriate, although not in the same way as in the case of the duck/rabbit. These are cases where perception could be said to be entwined with *imagination*. McFee (ibid. p.274) mentions another rare case that Wittgenstein discusses.

“But Wittgenstein contrasts the seeing of aspects, not only with (standard) perception, but also with another, rarer case typified by the seeing of a

triangle as having *fallen over*. As Wittgenstein says, *more* than mere looking and seeing is required here: ‘To see this aspect of the triangle demands *imagination*’ (PI, p. 207[h]).” (quoted from McFee).

In this case, the type of imagination employed is *constitutive*, the triangle is seen as fallen rather than upright, but it is still the same triangle in front of me, only constituted as being in a particular position. But there are other important cases where the imagination implicated in perception is *projective*, in this case the situation is deemed to be redolent of possibilities. We will shortly discuss a group of such cases in relation to expertise, where the possibilities are closely related to realisation.

I want now to turn to a range of cases particularly relevant to professional expertise where know-how and more specifically cases of knowing-wh. are implicated.¹³ These cases illustrate a two-fold phenomenon; that of seeking something out through a process of intentional scanning or scrutiny and the fixing of an intentional object relevant to a professional purpose.

Knowing what to look for

There are cases where the intention in the perception is overt, where there is a deliberate seeking. This case of intentional perception is different, but related to, the case where the object of perception is intentional in McGinn’s and Anscombe’s sense. In this latter case, the object of perception is constituted through a complex of one or more elements of perception, thinking will and memory. In the former case the intention lies in an act that is not yet fulfilled. In these cases, the perceiver will structure the perception in such a way that his intention may be fulfilled. This will in many cases involve the ability to discern detail (see above), but will also involve intentionality in the sense that what is looked for (and eventually perceived) is an intentional object. This (like the previous examples) involves awareness of salience in the scene observed, as in the workshop.

¹³ In such cases, knowing wh is to be interpreted as a form of know-how rather than propositional knowledge, contrary to much of the literature on the topic.

Research reported by Gobet (2016) goes into some detail about the expert's ability to see possibilities and his analysis suggests that there are significant differences between experts and non-experts in the ability to discern possibilities for action. The ability to identify relevant elements in the field of perception and to relate them to each other in ways relevant to the agent's objective is important, ('chunking'). This ability is itself developed at least partially through experience either gained through previous professional action or through study (or both), and in particular the ability to discern likenesses to previously encountered or studied patterns is important (the construction of templates). The research reported deals in 'freeze frame' situations within an evolving situation (specific positions on a chess board). Gobet does not describe studies of expert perception in more dynamic situations, but it would be reasonable to assume that similar differences between expert and non-expert can also be found in these situations.

Thus the chess player sees the board as a game of chess (an example of 'chronic' aspect perception) and looks at the strategic situation for Black. The chess player is looking for a crucial configuration on the chessboard that will enable him to press his own advantage. In Gobet's phrase, the player is looking at the board in terms of *chunks*, that is, related parts of the board that are relevant to his objective (to achieve checkmate for Black).¹⁴ This may involve using memories of positions to situate a section of the board as relevant to the objective of the game. In this case, Black is thinking in terms of *templates*,¹⁵ or cognate board configurations relevant to the situation on this board. These chunk memories help to identify sections of the board particularly relevant to the intention. The chess player will then possibly see checkmate in three moves (he sees possibilities in the situation – he sees the position as mate in three moves for Black).

These possibilities may or may not be seen by another player, but this does not mean that Black has to withdraw his claim, thus making it a case of intentional perception in McGinn's and Anscombe's sense. However, in this case there is a clear possibility for the player to get someone else to see the same potential through a process of reasoning. In this case he sees the position as mate in three moves and may persuade

¹⁴ Gobet 2016 p.53.

¹⁵ See Gobet op.cit. for this term, by which he means using chunks acquired through previous experience reconfigured in terms of the actual situation confronted (op.cit., p.80).

another player to see this as well and, possibly to hold that perception over a period of time. Although the locution of ‘seeing as’ is quite natural in this example, it is a different kind of case from the duck/rabbit example, which contains an element of surprise as the aspect switches (Now I see it as a rabbit!), which as Wittgenstein observes (PI. II, p.197) makes the expression of the realisation of aspect change more like an exclamation than a description. Unlike this case, getting someone to see a position on a chessboard as Black to mate in three moves involves a process of persuasion. The dawning of the realisation that the position on the board contains this possibility is the result of explanation and persuasion.

Knowing where to look

The experienced chess player in the example above knows *what* to look for, namely crucial configurations on the board, relevant to the objective of the game. We could say that a dual intentionality of perception was in play in this case: the intention to find something which itself is constituted as an intentional object. The chessboard example is a relatively stylised and circumscribed situation which is also static (although with dynamic possibilities). In many examples of a professional field of action, the situation is not closely circumscribed by convention, can be open-ended and is certainly dynamic. This does not mean that Gobet’s categories of chunks and templates are irrelevant to such situations, but that they are more complex and potentially difficult to bring under the agent’s control. Empirical studies are needed to examine whether or not conceptualisations in terms of chunks and templates have as good explanatory value in highly dynamic situations as they are in relatively static ones such as a chess game.

Thus, compared with identifying a relevant chunk on a chessboard, the task of finding the relevant events, processes or states of affairs in the complex environment of a battlefield, a classroom, an operating theatre, a scene of crime or an accident, an air traffic configuration or a complex engineering operation will be less straightforward. In such situations, knowing *where* to look for *what* you want to find can itself be far from straightforward. However, a successful outcome will be the perception and identification of a complex intentional object which may be characterised in terms of possibilities (as in the chess case). Here again, thought and memory play a role in the constitution of the object of perception. It may also be that the situation strikes the

general on the battlefield in a surprising way – ‘now I see his weak point!’, rather like but not to be identified with aspect change.

The battlefield is more complex than the chessboard which could be seen as a relatively stylised form of battlefield. A military commander has usually to deal with a fluid and dynamic situation of greater complexity, as well as an opponent who reacts in real time rather than in turns. A battlefield’s spaces may not be so easily available as ‘chunks’, crucial states of affairs and events may be widely distributed: reserves to the rear, a diversionary manoeuvre in a distant corner of the action. Background knowledge of units in the field of perception will affect how they are seen in terms of capacity for action. The general’s knowledge of their morale, fatigue, endurance and tactical ability will all affect how he sees them as instruments of possibility.

Thus, not only is knowing where to look in the first sense of ‘intentional’ more complex, but the intentional objects of perception (the possibilities for defensive action, for a breakthrough, for a tactical withdrawal) may be more diffuse and less amenable to bringing to the attention of another observer. It may be quite natural to say that the general sees the battlefield as a field of various possibilities, but misleading or an exaggeration to say that he sees it aspectually in the sense of the duck-rabbit situation.

Knowing when to look

This is particularly relevant to dynamic situations: the ability to see that an evolving process has reached a certain point at which it may be anticipated that an occurrence will take place, possibly at a certain location. Like the examples above, perceptual scanning and scrutiny, usually of a dynamic situation, is involved which issues in the perception of a *possibility* (eg to make a cross in football) or a *necessity* to commit reserves in battle.

In these cases, it is not as if the agent is not continuously engaged in perceiving the situation and indeed seeing it in terms of intentional objects. However, perception is also anticipatory, the agent expects that there will be a critical development and he/she is on the lookout for it and attuned to take action when it occurs. The ability to be on the perceptual alert for such developing situations is often an important feature

of expertise, marking off the expert from the novice or merely competent practitioner who again is unable to see the developing possibilities within a complex situation within his perceptual field. There is also in such perception an element of *thinking ahead* towards the possibilities which is itself related to the will (the desire to take a certain action when the possibility arises), and memory (using past knowledge of evolving dynamic situations) as clues to developments in the present as in the case of the templates that Gobet refers to.

In the cases so far examined, the varieties of perception have not been seen as *interpretations* of what is seen, they are examples of perception, albeit intermingled with elements of memory, imagination, thought and will. But, it might be said, aren't these just the resources that we bring to perception when we interpret what we see or hear as something? Then, what is the difference between perceiving an intentional object and interpreting what is seen/heard as something else?

The general sees what looks like the chaos of a battlefield to non-military onlooker and interprets that as a threat or an opportunity. He sees the battlefield as redolent with possibilities and threats. Nevertheless, the general did not always possess this perceptual ability; as a young drummer boy, battlefields appeared chaotic to him. Greater experience taught him to see a purpose and sense in the complex events around him.

When he went to the staff college he was given studies of battles, with maps and war games to help make sense of why events turned out as they did. He learned to interpret apparently meaningless situations as manoeuvres: feints, reconnaissances, assaults and retreats and alongside learned the descriptive language that belongs to military strategy and tactics. In due course the finely detailed features of the battlefield are seen for what they are: redoubts, natural obstacles, cover, lines of sight and the evolving situation is just seen as a flanking manoeuvre, an advance under cover or combined arms assault. The point is that sometimes interpretation of what is perceived is required to make sense of it, and even that sometimes the boundary between seeing something as something and interpreting what is seen as something is not always clear. We could even say that something like training, instruction and practice is required in order to make an interpreter into a 'seer-as'.

The example above illustrates that as well as memory and thought, *imagination* plays a role in the perception of such complex dynamic processes as a battle. Partly this is constitutive, where for example, the disparate aspects of the battlefield are seen as a unity (Ney at Quatre Bras, Blucher at Wavre and Wellington at Waterloo) and partly as projective, where Ney's action at Quatre Bras can be seen as a movement against Wellington's main army. We can envisage an experienced commander such as Napoleon, seeing the battlefield and its surroundings thus. A less able observer would have to have the scene interpreted for him. Wittgenstein relates imagination to much more than mental imaging, which is not even a necessary criterion of imagining something. The relationship is closer to that of *how one takes things to be*, not in the customary 'chronic' sense described above, but in the sense of seeing a situation anew, or realising the possibilities latent within it.¹⁶

IV. *Perception, Expertise and Professional Education.*

What conclusions can we draw about expertise in professional work and the necessary preparation for acquiring expertise? The discussion has emphasised the variety of perceptual phenomena that can occur in professional work, both intentional and non-intentional. In the case of non-intentional perception (in Anscombe and McGinn's sense) representational conventions are important: the drawing, the blueprint, the diagram, the map or the picture must be taken as such. Furthermore, the ability to see relevant features within the representation is important (Wollheim's twofold sense of seeing in). The other important case of non-intentional perception is the ability to see detail and nuance whether it be in a real situation like a classroom, a surgical operation, a football match or an accident, or in a representation like a map or blueprint. The expert should not only be able to 'see in' – this, we can assume, is a prerequisite for any kind of competent performance, but should also be very rapid and accurate in locating and identifying detail in the relevant field. The expert microscopist and the astronomer should be able to do this and often to show

¹⁶ The empiricist tradition tends to think of imagination in terms of a] lack of vividness compared to perception and b] in the ability to 'slice and dice' imagery (refer to Hume's discussion). But Hume and Kant also thought of imagination *constitutively* as organising sensation into coherent perception (see Hume *Treatise*, Bk.I, Part IV, Kant *Critique of Pure Reason*, Analytic of Concepts, Chapter 1, Section 3). See also the discussion in Glock (ed.) 1996. Wittgenstein's discussion, while keeping close the link between perception and imagination, downplays the role of imagery. However, the constitutive aspect of imagination is given its due through the discussion of 'chronic' aspect perception, although not in the quasi-mechanistic form to be found in Kant.

endurance and persistence in doing so over a prolonged period so as to understand dynamic phenomena as in the case of the biologist John Sulston or the astronomer Tycho Brahe. In such cases, the distinction between the intentional and the non-intentional sides of perception is not always easy to maintain. Thus for example, detailed and repeated observation of the movement of celestial bodies will reveal interesting changes in position relative to other bodies which only very careful observation might reveal, but to see them as circular rather than epicyclical is to suggest a way of fitting the observed phenomena into a larger set of coherent phenomena which requires a shift of perspective from geocentricity to heliocentricity.

Intentional perception is critical in understanding expertise. A permanent orientation to the workplace and the work, where work relevant features of a situation are salient to the agent is, again, a prerequisite of competent performance, not just of expertise. However, the type of case that Wittgenstein discusses at length, of aspect change and of holding an aspect, may occur relatively infrequently in professional situations, but may, nevertheless, be important. They may well occur in those circumstances where a change in perspective becomes important in solving a number of associated anomalies or puzzles, as in the example above.¹⁷ More generally, it may often be necessary to see phenomena afresh, not necessarily in the sense of finding more detail, but in the sense of seeing them from a different aspect, perhaps a theoretical perspective that alters a line of enquiry or even brings into question a system of classification and hence a conceptual shift.¹⁸

The above example relates to the association of projective imagination with perception, but willing and thought may also play an important role in professional perception. We have already seen how percepts may be organised into structures informed by previous experience as Gobet and Keestra in this volume explain. The ability to see a phenomenon under one aspect rather than another as in the examples above may again require an effort of will to break free of habitual seeing. The goal-directedness of much professional activity means that the agent is directed towards an outcome or a solution and this also informs the way that a situation is perceived, as redolent of possibilities perhaps or in a way that offers a possible solution that

¹⁷ Ref Kuhn 1962,

¹⁸ The examples of whether fragmentary fossil remains should be seen as whole creatures or as body parts is discussed in Gould (op.cit.).

previous habitual perception of similar situations does not. McFee's claim that Wittgenstein was concerned with bringing to our attention a wide range of cases, not just those that he discusses in detail, is relevant here. What is very often important to the agent in a professional situation is the perception of *possibilities* in both relatively static and in dynamic situations. Possibilities are important because they are indicative of future courses of action, and often require immediate and decisive judgement and decision-making. They may also precipitate significantly different ways of regarding a situation, perhaps involving a conceptual shift in certain respects.

Possibilities seen by one agent may not be available to another. One agent may persuade another that there are such possibilities and that different methods of persuasion may be necessary in different cases, ranging from ratiocinative (eg. going through the various positions for Black to achieve mate in three moves, to drawing an analogy between a current battlefield position and an historical one, to playing a piece of music in a certain way rather than another). We can also allow that the element of surprise which Wittgenstein thinks is important in the Jastrow case can also sometimes play a role in professional cases. The idea of surprise is a theme in both Wittgenstein's earlier and later philosophy and relates also in the later work to the idea that manipulation of symbolism can surprise us by its result, even though the result is immanent in a formula.¹⁹ Wittgenstein then extends this idea to the ways in which other kinds of representation can induce surprise and we can further extend to cases, relevant to professional action, where there can be different ways of seeing a situation. 'Yes, now I can see the injury as other-inflicted rather than self-inflicted!'; 'now I can see an opportunity for a breakthrough in the undefended section between the wood and the stream!' and 'yes, I can hear the melancholy in the piece that you have just played!'

Wittgenstein draws attention to the involvement of thought and the will in certain kinds of perception and, in some cases, to the involvement of imagination as in the fallen triangle case. But we can go further in showing how perception is involved with other mental phenomena in professional judgement. As well as the constitutive imagination case, where the triangle is seen as upright rather than fallen over, the projective imagination is important, sometimes in anticipating how a situation is about

¹⁹ See Floyd (2017) for a further explanation of the role of surprise in Wittgenstein's philosophy of mathematics.

to evolve and sometimes in discerning promising lines of action in evolving situations.²⁰ But we can also note the role that memory plays in professional perception and the ways in which current situations can display similarities to situations previously encountered or studied, thus helping to disclose their possibilities for the agent's judgement or intervention. Here experience can play an important role, providing templates in Gobet's sense which combine the use of chunks (configurations dependent on memory), with re-arrangement to cope with a new situation (templates), thus showing how thinking is entangled with perceiving in such situations.

Thus, to describe (relative) expertise in terms of intuitive fluency as in the work of Dreyfus and Dreyfus is to oversimplify. Although the use of templates can sometimes happen in a way consistent with their own descriptions, it may also involve a more extended re-arrangement of phenomena, tracking between what is seen, what is known theoretically and what the phenomena might look like if they were seen in a different context, or as part of a different development.

V. Implications for Professional Education

I want to conclude with some brief comments on the implications of these considerations of perception for professional education. The thrust of these comments concerns the need for awareness of the development of perceptual ability in the transition from novicehood to expert in the construction of programmes of both initial and continuing professional education. Much of this is no doubt already done in high-quality programmes, but by making the different dimensions of perception explicit, the likelihood that critical elements in the development of expertise will be omitted is reduced.

The first point concerns the *aims* of professional education in relation to perceptual ability. Here it is necessary to state that the development of perceptual ability at all stages of professional education is a necessary part of the development of expertise. Stating this as an aim marks its importance. Second, the place of the development of perceptual ability in its different aspects needs to be explicitly set out in *curriculum*

²⁰ Another example would be the extrapolation of a peasant woman's life from the depiction of a pair of shoes in Mulhall (1990), where the projection is more aesthetic and tenuously extrapolatory. But such a projection may nevertheless have a role in professional work and have the potential for productive surprise.

documents so that educators can see clearly what abilities are to be developed and when. Third, the *pedagogical* implications need to be made clear. Even though for example the development of perceptual ability and concept mastery may be different aspects of the curriculum, it does not follow that they are not to be developed together in an integrated way. Although there is not the space here to develop this point, it is likely that success comes from the pedagogical integration of these and other abilities. It is also a clear pedagogical implication of what has been argued above that various kinds of experiences are necessary to the development of perceptual ability, including theoretical instruction (e.g. in the important templates to be encountered) and various controlled and subsequently operational situations in which the relevant abilities can be developed progressively.

Fourth, the right *resources* need to be provided in order to ensure that such abilities are developed. These will include equipment of the right kind, but also the ability to engage in simulated and non-simulated environments in which the development of such abilities is made possible. Fifth and finally, *assessment* of perceptual ability needs to be built into processes of professional qualification and, since the qualification is the final guarantee of competence or expertise, assessment needs to include the scrutiny of perceptual ability in operational conditions, as well as an assessment of how the candidate is likely to react in hypothetical circumstances.

It is probably true that many qualifications and assessment criteria do not dwell explicitly on this aspect of operational work except in an informal way in, for example, the assessment of a student's performance in a teaching practice. One is looking here for, not just the ability to see detail in a classroom situation, although this will be important, but also an ability to perceive *latency* (what might develop) and *immanence* (what is significant about an apparently banal event). These are more than just exercising 'perceptual skills', but relate to the ability to focus attention and to take seriously the significance of certain patterns, involving the memory and imagination of the agent. Although the criteria for determining that someone appreciates these subtle phenomena are ultimately the product of a settled practice of judgement of teaching ability, it is also important that they be formally articulated in an assessment procedure, both to ensure against the case where they are altogether omitted, to eliminate simple reliance on intersubjective agreement and to make clear

to both assessor and candidate that they will be significant (see the discussion of criteria for assessment in the Introduction to this volume).

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